NISTTech

Normal Metal Boundary Conditions for Multi-Layer TES Detectors

Improved temperature and particle detection via superconducting materials

Description

Greatly improve the superconducting transition abilities of multilayer transition-edge sensors (TES) by adding metal strips or banks along the edges of its superconducting and normal metal layers. TES provide a total power rate or energy deposition by measuring the increase in the resistance of a superconducting material. These strips provide for both improved detector performance and robustness against corrosion. This improvement is an important advance particularly for TES-based microcalorimeter detectors. The improved TESs also have many other applications based on the very precise thermometer function achieved by the TES.

Applications

- **Thermometers**
  Sensitive to minor fluctuations in temperature.
- **Particle detectors**
  Using TES with absorbers provides sensitive measurements of particles including photons, x-ray photons, molecules, electrons, ions, and phonons.

Advantages

- **Improved TES based x-ray and infrared detectors**
  Provides an alternative to using edge passivating films and the resulting energy loss due to energy trapping in the film.
- **Avoids corrosion and compromised resistive transition**
  Protects the interface between normal and superconducting layers of multilayer TES.
- **Better transition leading to better measurements**
  No stress cracking or delamination along the edge of the bilayer, leading to a variation in proximity-effect coupling across the width of the bilayer.

Abstract

Multi-layer transition-edge sensors (TES) having improved performance, a method for preparing them and methods of using them. Specifically, the improvement lies in providing normal metal strips along the edges of the superconducting and normal metal layers parallel to the current flow in the TES during operation. These strips (referred to as "banks") provide for both improved detector performance and improved detector robustness against corrosion. This improvement is an important advance particularly for TES-based microcalorimeter detectors. The improved TESs also have many other applications based on the very precise thermometer function achieved by the TES.

Inventors

- Hilton, Gene
- Irwin, Kent
- Martinis, John
- Wollman, Dave

Citations

1. NIST Docket # 94-005, U.S. Patent # 5,634,718, Particle Calorimeter with Normal Metal Base Layer
2. NIST Docket # 97-040, Patent # 6,239,431, Superconducting Transition-Edge Sensor with Weak Links

References

- U.S. Expired Patent # 6,455,849
- Docket: 99-035US

Status of Availability

This technology is available in the public domain.

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